



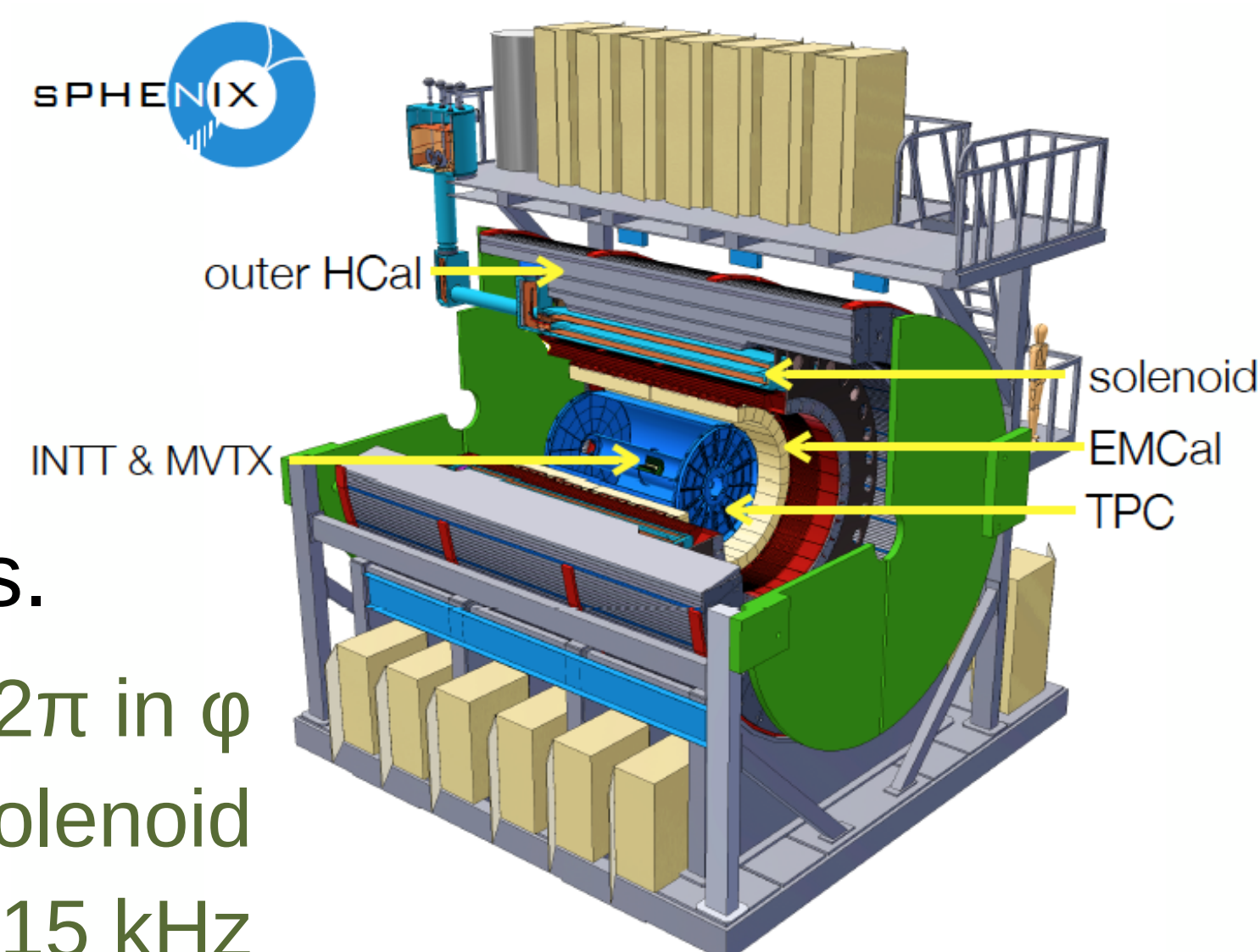
Cold QCD Physics with sPHENIX and Potential Forward Upgrades

Zhongling Ji for sPHENIX Collaboration

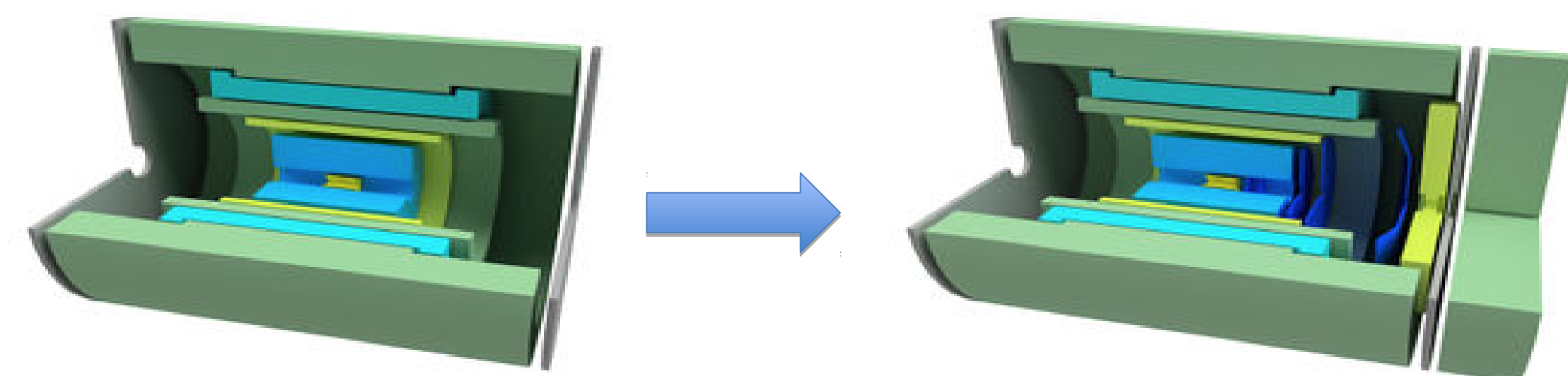
Introduction

- For studies of the strongly interacting quark-gluon plasma using jet, photon and heavy-flavor observables.
- Strong opportunities in Cold Nuclear Matter and Spin studies.

$|\eta| < 1.1$ and 2π in ϕ
Tracking in 1.4T solenoid
DAQ 15 kHz



Forward upgrade

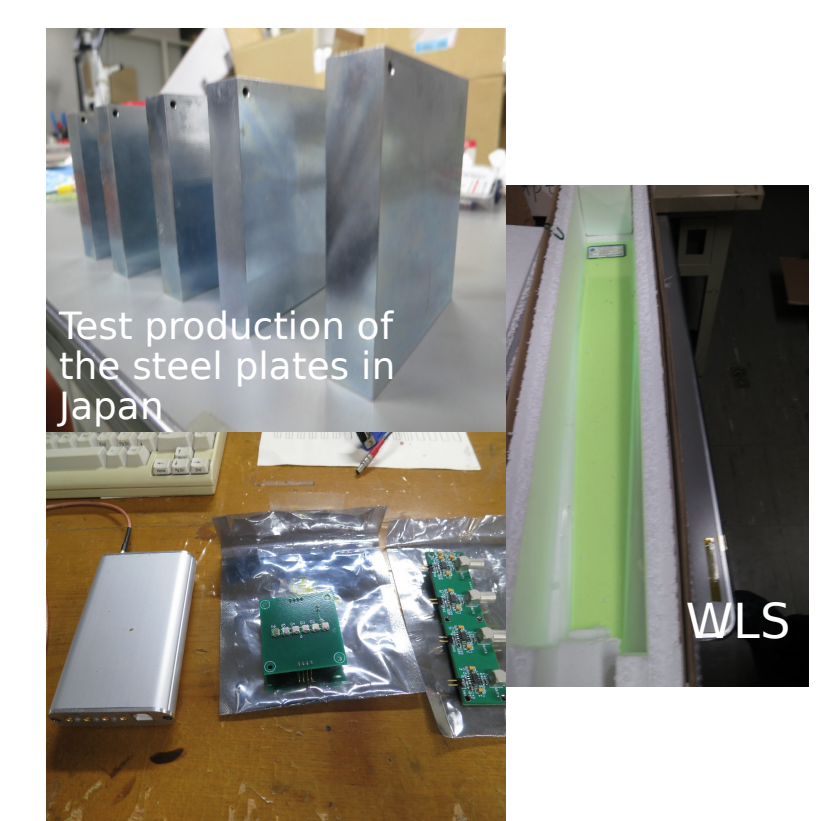
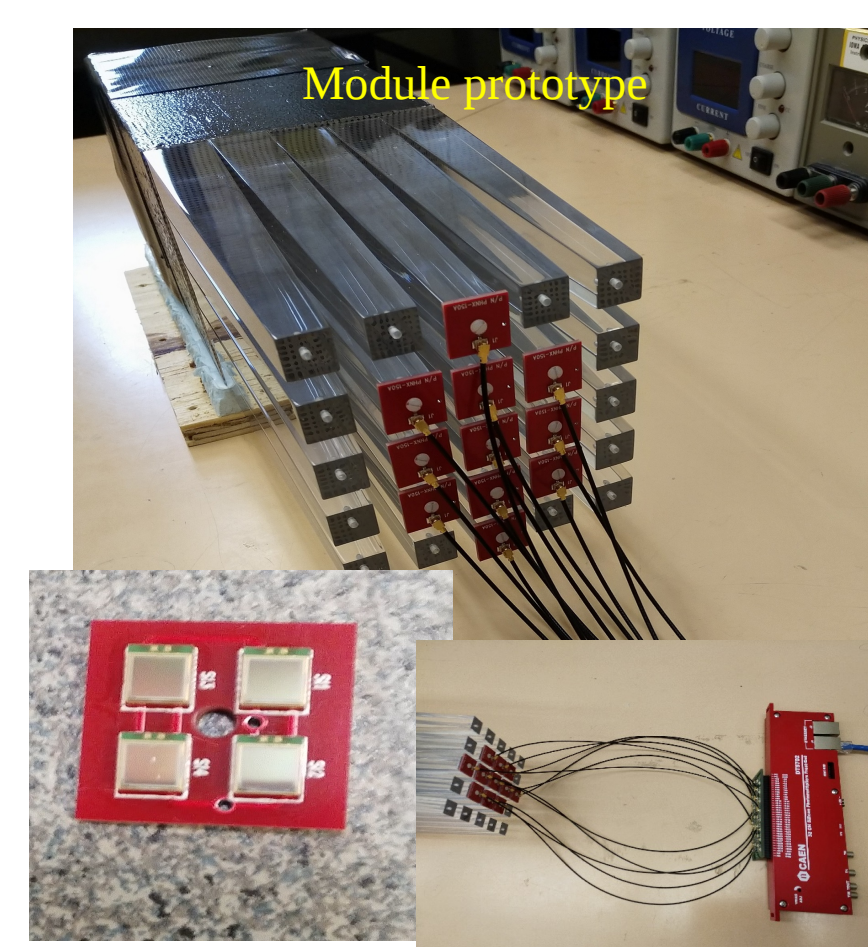


Solenoid 1.4T
EMCal & HCal
Tracking

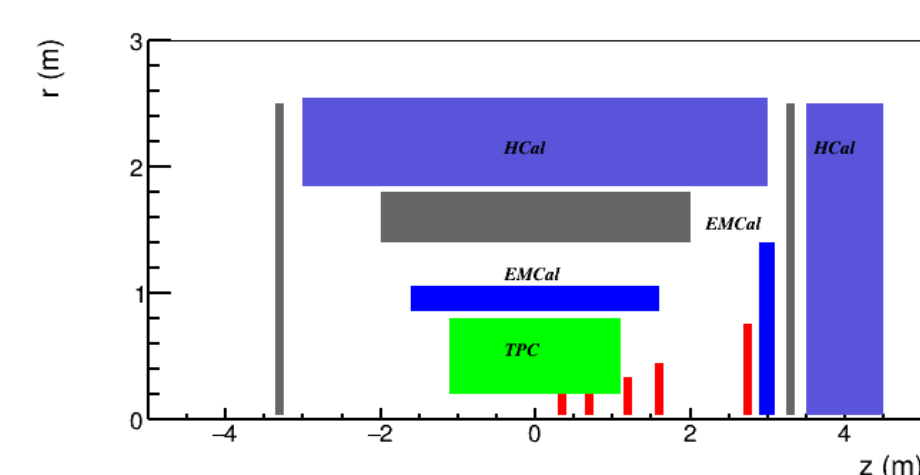
+ Forward EMCAL & HCal
+ Forward tracking

Forward EMCAL R&D

HCal R&D (Test beam data in Femilab, April 2019)

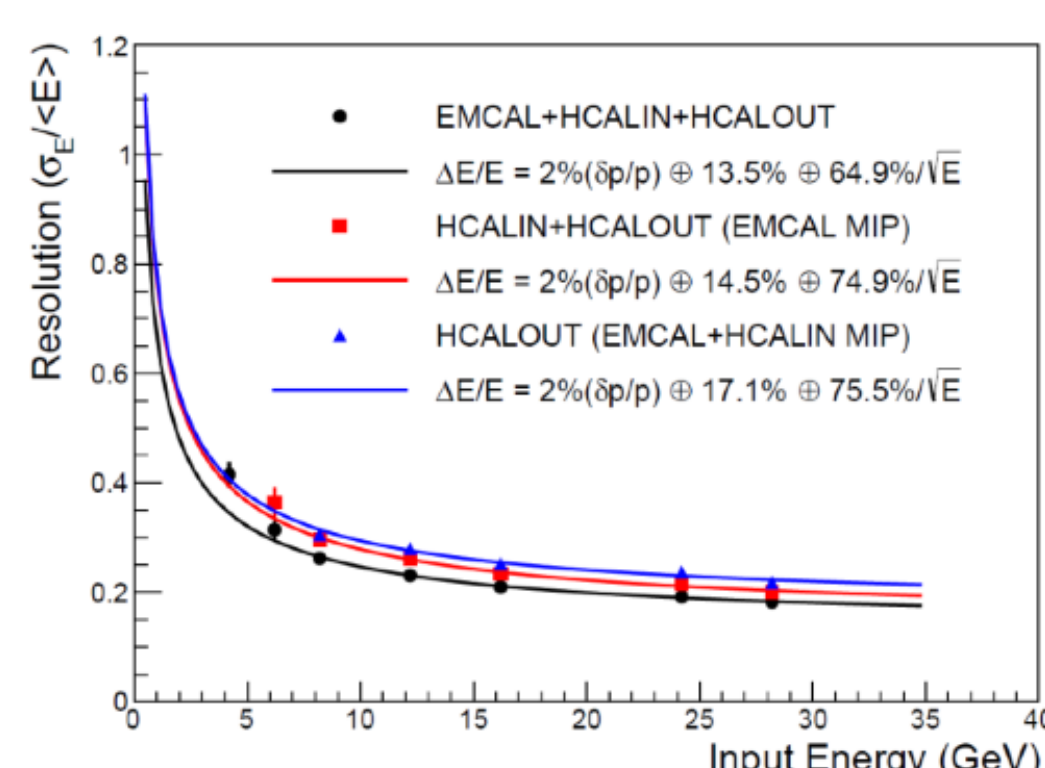


MVTX for $|\eta| < 2$, forward tracker needs to cover $\eta = 2-4$
➤ GEM or sTGC considered



sPHENIX strength

Calorimetric jet measurements

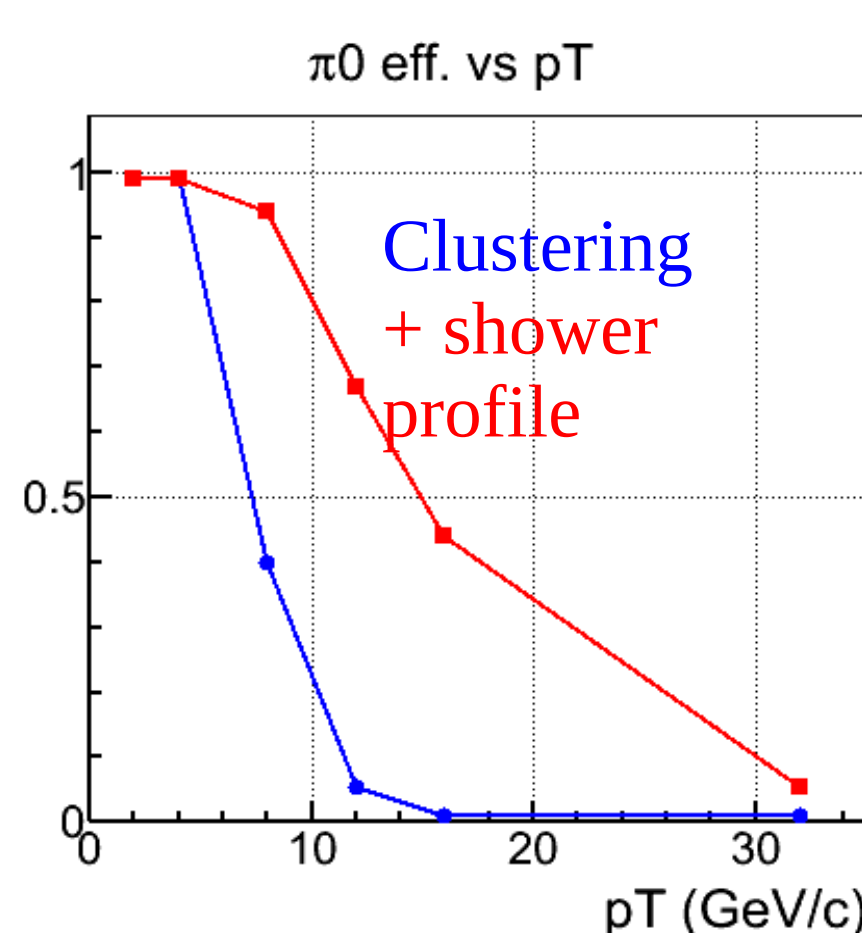


Discriminate γ/π^0 up to 20 GeV/c

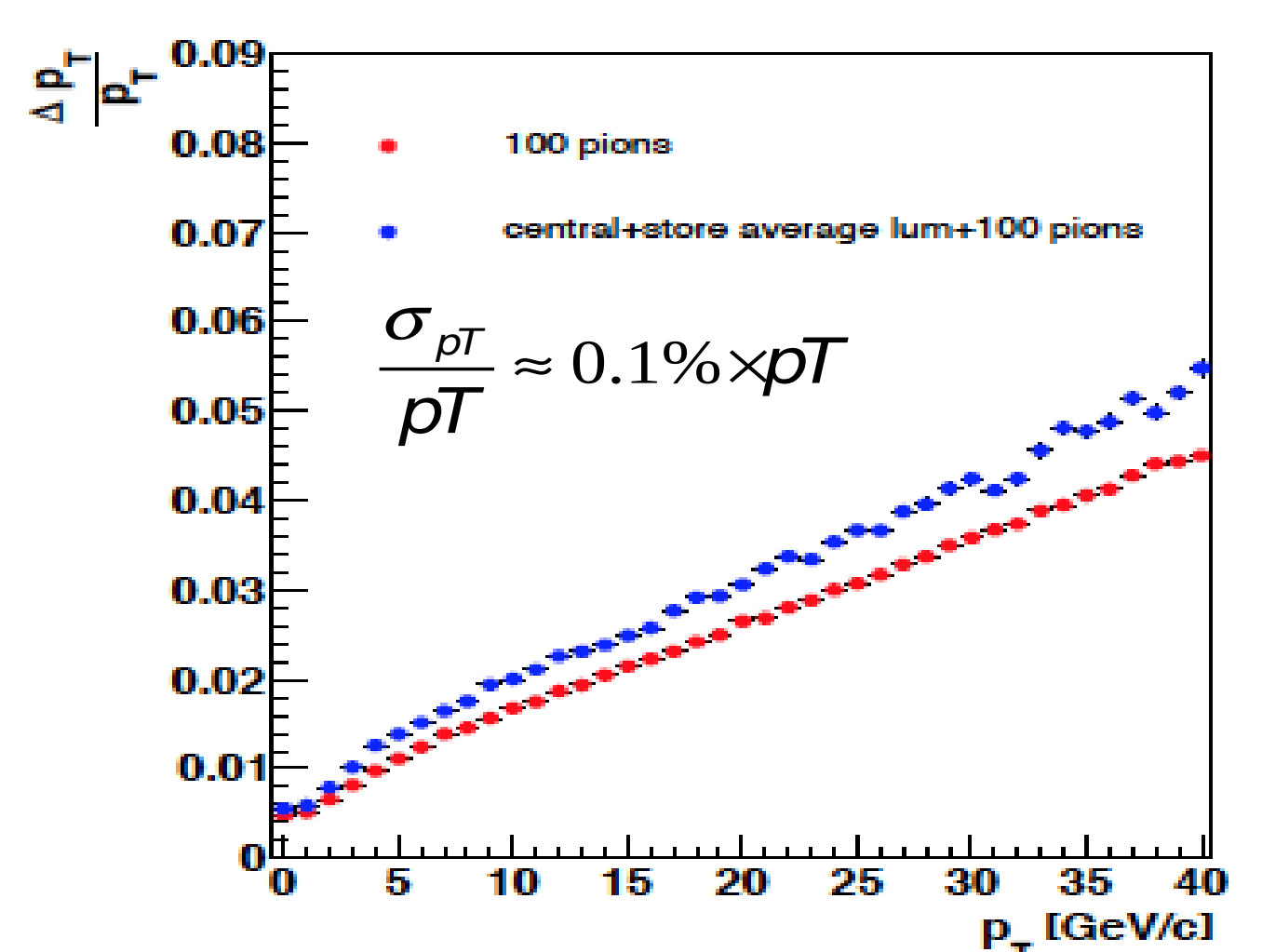
Good Calorimetry:

$$\text{EMCal: } \frac{\sigma_E}{E} \approx \frac{15\%}{\sqrt{E}}$$

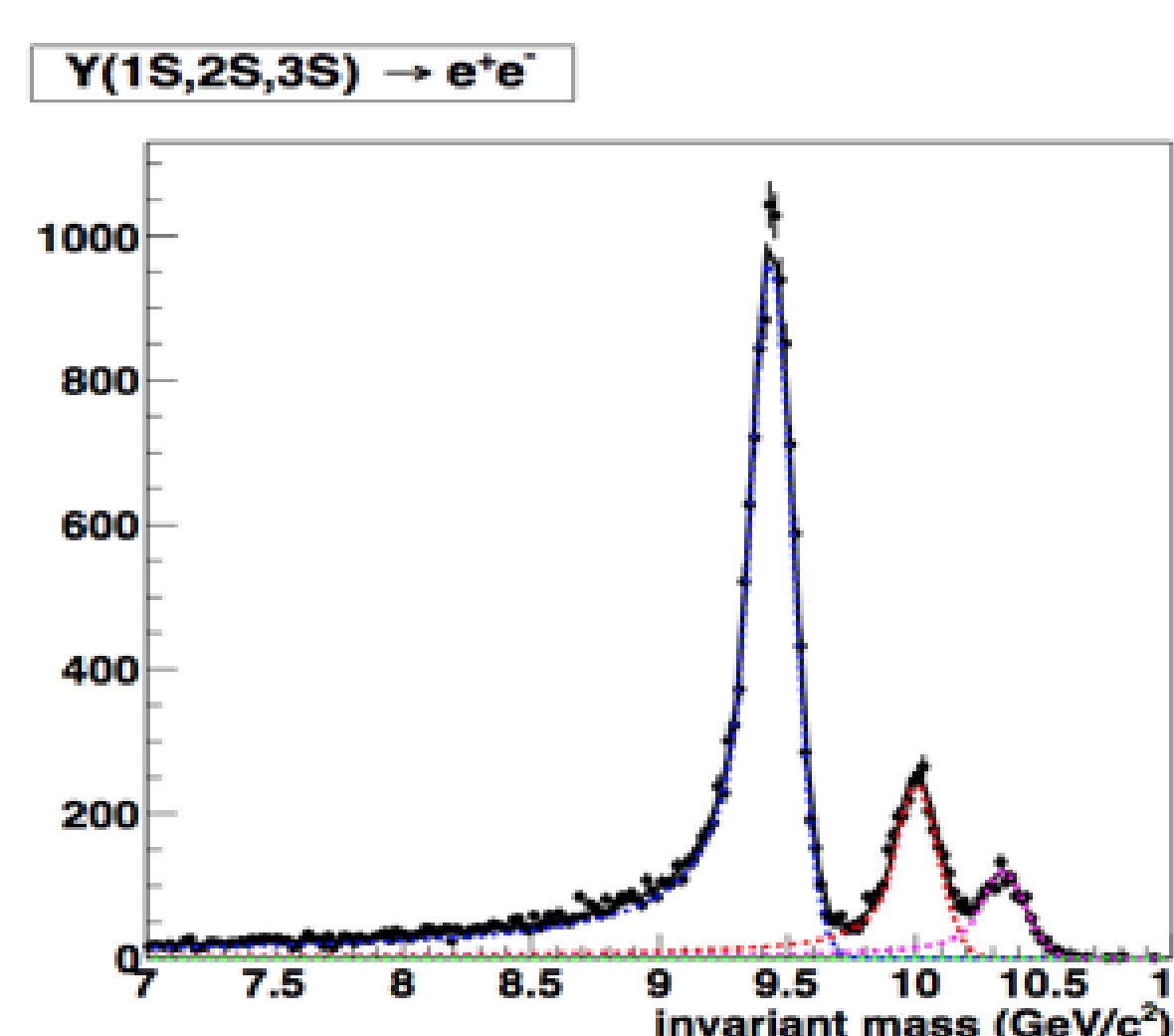
$$\text{Hcal: } \frac{\sigma_E}{E} \approx \frac{100\%}{\sqrt{E}}$$



Excellent tracking



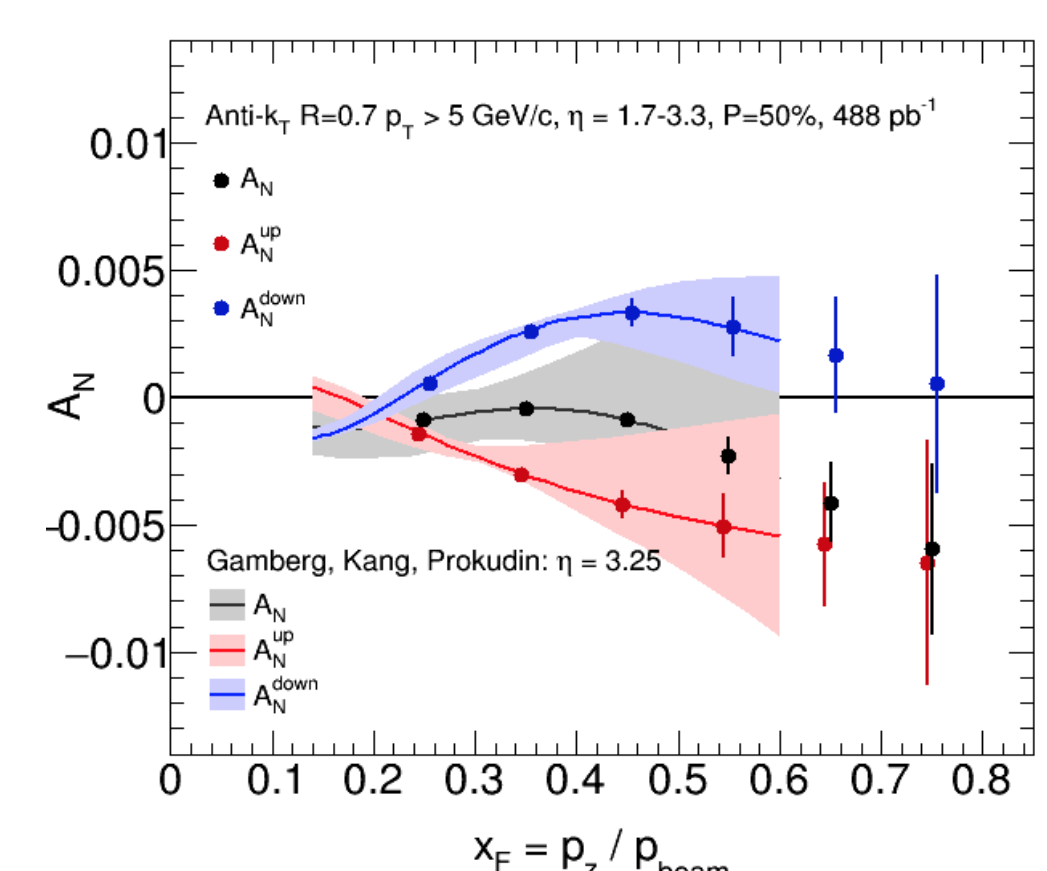
Excellent mass resolution for quarkonia states



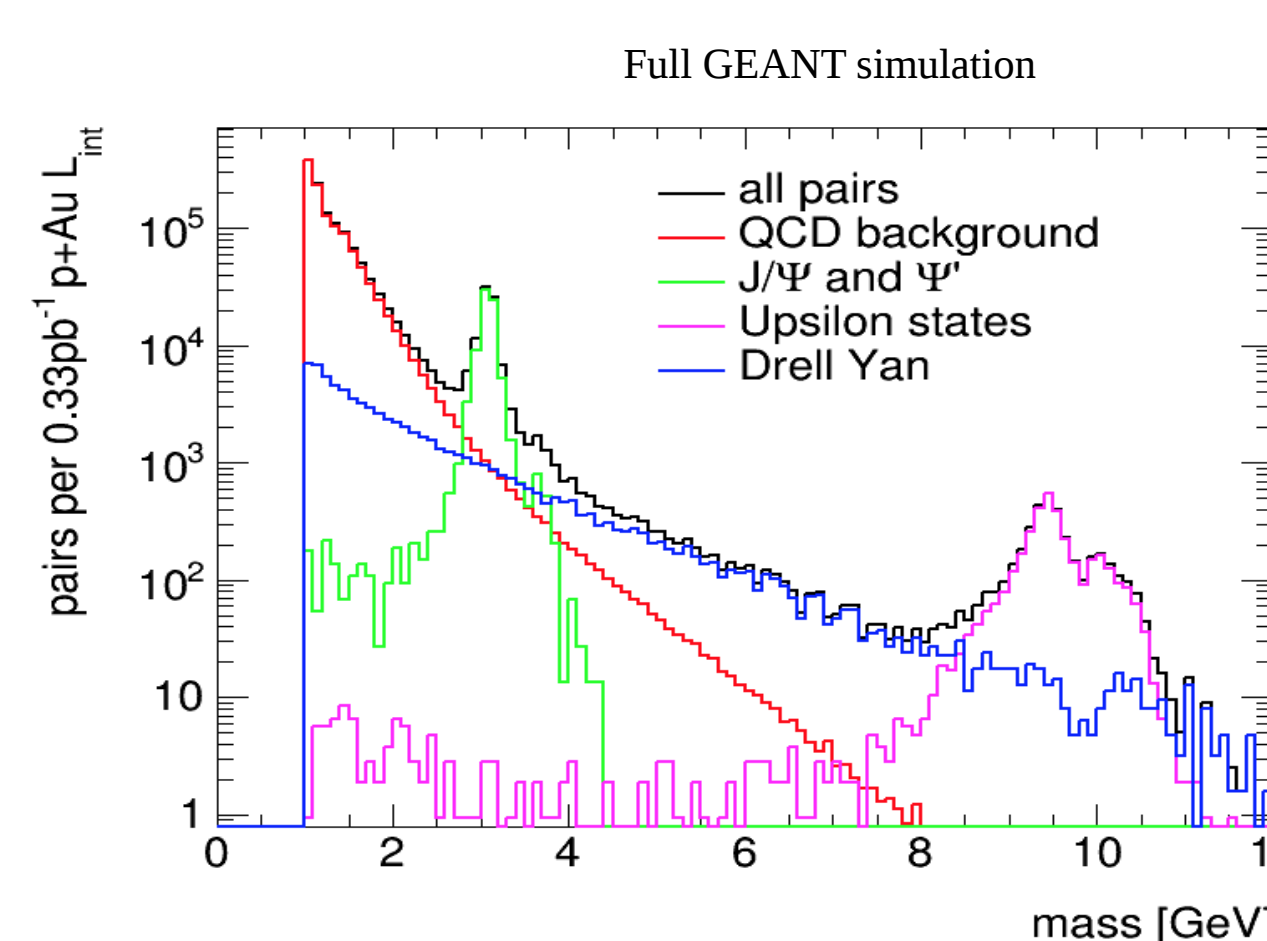
Forward physics

- Expands QGP jet tomography
- Long range correlations
- Forward spin phenomena
- nPDF and nFF

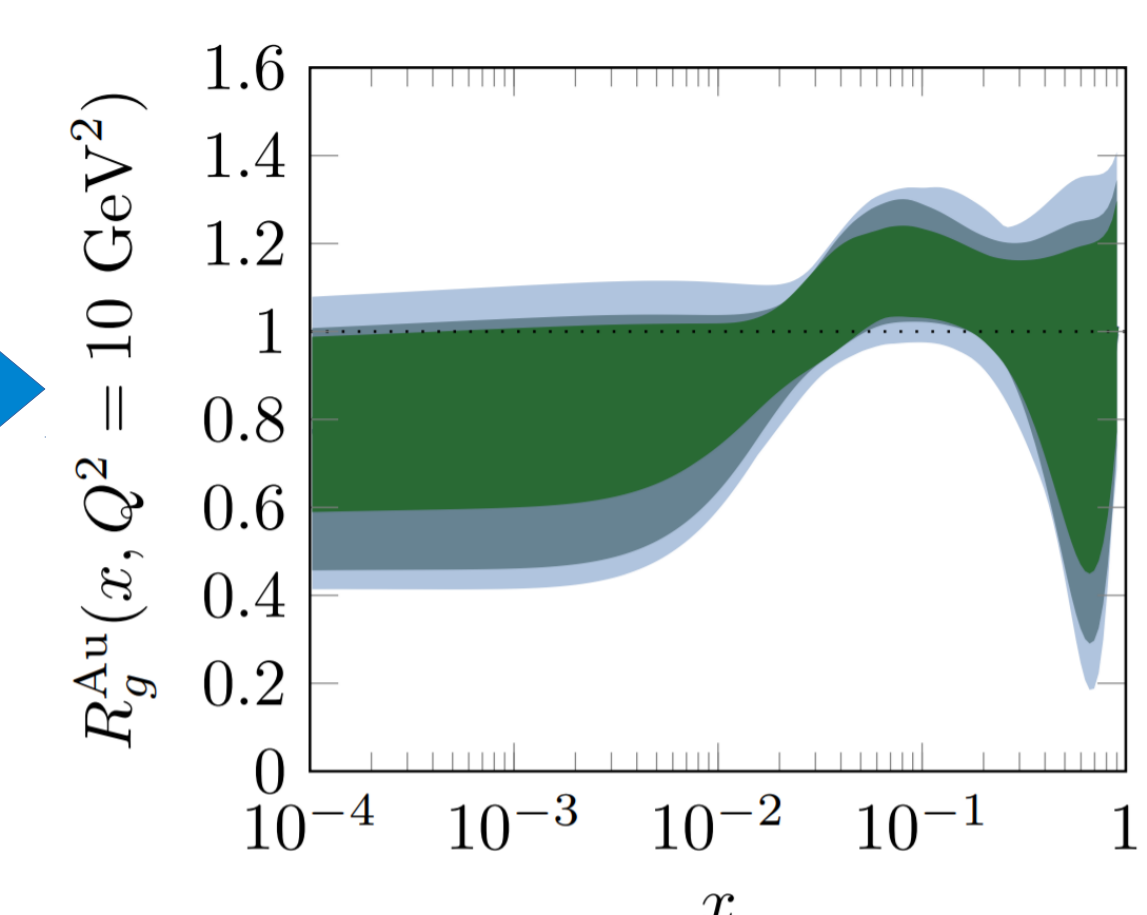
Sivers from u/d quarks



DY at $5 < m < 8 \text{ GeV}/c^2$

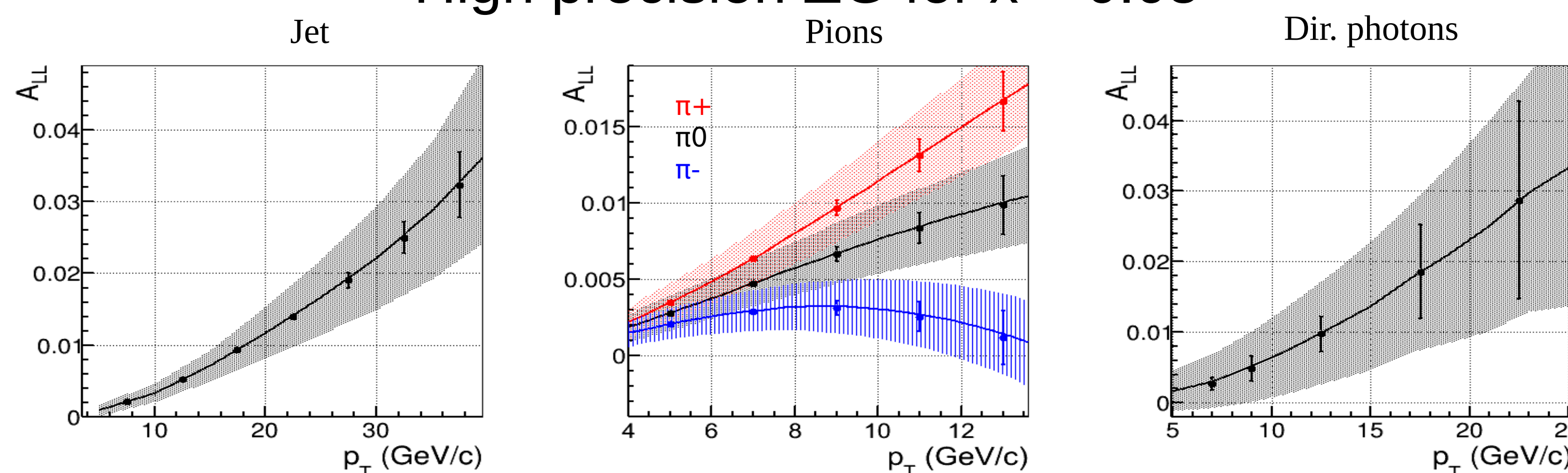


nPDF fit projection: constrain the lower x
arXiv: 1904.09921



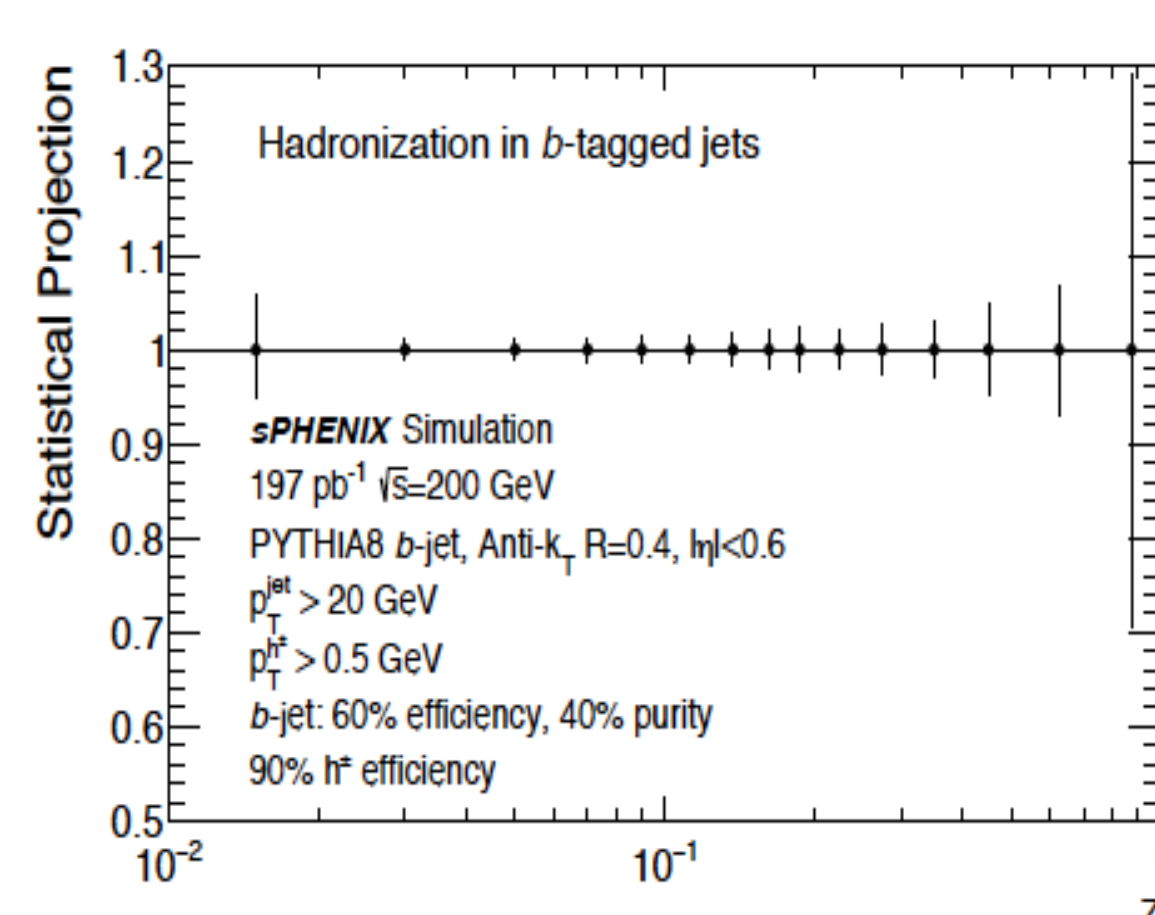
Cold QCD physics

High precision ΔG for $x > 0.05$



- ΔG : highly complementary to a future EIC
- Transversity: Collins/IFF asymmetry
- Twist-3 structure: HF, dir. photons
- k_T and j_T evolution
- nPDF and hadronization

Parton hadronization



Conclusion

- In addition to exciting QGP program sPHENIX will provide a broad range of high precision Cold QCD measurements
- Even more opportunities with proposed forward instrumentation

References

arXiv: 1501.06197